

The Biosphere

Earth's Spheres

* In the first academic term, you studied that Planet Earth consists of four interconnected spheres:

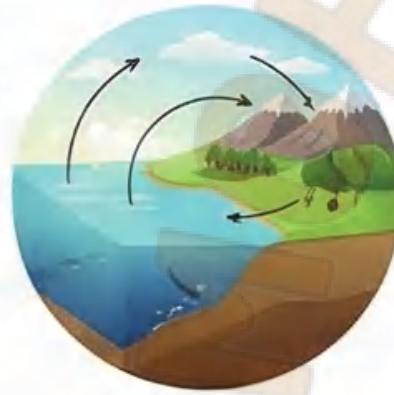


* You have already studied the hydrosphere and the atmosphere. In this unit, you will study the biosphere in more detail.

The Biosphere:

A part of Planet Earth where all forms of life exist, and it represents a large integrated system:

- It extends from the depths of the oceans to the tops of mountains, passing through land and air.
- It includes all living organisms on Earth and the environments in which they live.
- All forms of life interact (affect and are affected) with the other spheres of Earth.



Relationship between the Biosphere and the Other Earth Spheres

* The biosphere is closely connected to the other spheres that make up Planet Earth. It does not function independently, but rather depends on them for the continuity and balance of life.

Living organisms that constitute the biosphere continuously interact with the atmosphere, hydrosphere, and lithosphere as follows:

The Atmosphere: Provides essential gases such as oxygen required for respiration and carbon dioxide required for photosynthesis.

The Hydrosphere: Supplies living organisms with water necessary for all vital biological processes.

The Lithosphere: Provides mineral elements through soil, which plants depend on for growth and stability.

The life cycle of a plant is an example of interaction between the biosphere and the other Earth spheres as follows:

1- The plant during its life

The plant absorbs water and mineral salts from the soil (hydrosphere and lithosphere) and carbon dioxide from the air (atmosphere). In the presence of sunlight, this results in:

- Food that enables growth within the biosphere.
- Water vapor (atmosphere), which becomes part of the water cycle in nature (hydrosphere).
- Oxygen released into the air (atmosphere).

Water + Mineral salts + Carbon dioxide + Sunlight → Food + Oxygen + Water vapor

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Hydrosphere Lithosphere Atmosphere Biosphere Atmosphere Atmosphere Hydrosphere

then

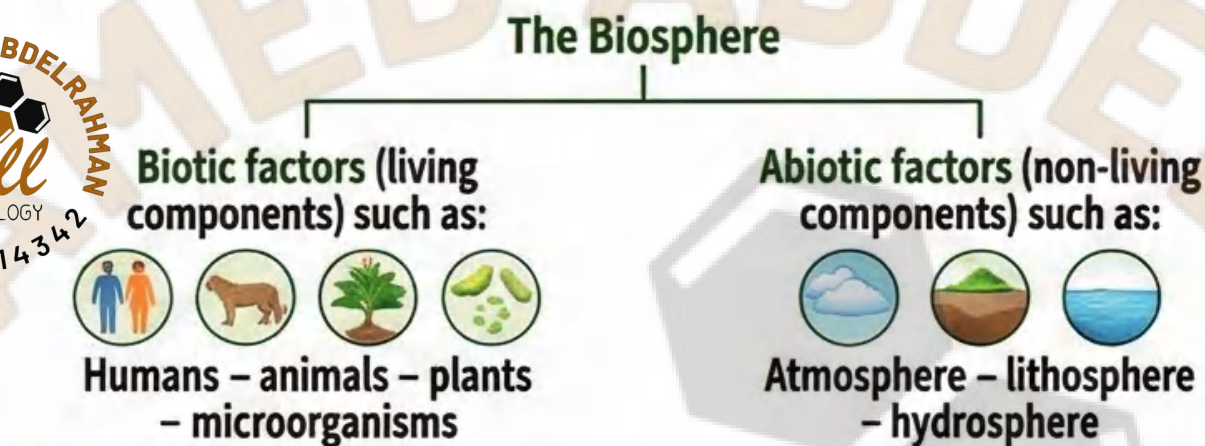
2- The plant after its death

When the plant dies, it decomposes into simple substances that become part of the soil (lithosphere).



Components of the Biosphere

* The biosphere contains living and non-living components that work together as a balanced system making life possible on Earth's surface.



1- Biotic Factors

Biotic factors: All living organisms that affect the environment and are affected by it, such as plants, animals, and microorganisms.

* Living organisms in the biosphere continuously interact with the surrounding environment in a constant exchange of matter and energy, performing different roles within ecosystems.

Thus, we find that:

Plants (Producers)

- Produce food through the process of photosynthesis.
- Represent the primary source of energy for other living organisms.

Animals (Consumers)

- Depend for their food on plants or on other animals (predators).

Some microorganisms (Decomposers)

- Decompose the remains of dead organisms and return basic materials and elements to the environment to be reused (such as bacteria and fungi).



2- Abiotic Factors

Abiotic factors: Non-living components of the environment, including light, water, temperature, soil, minerals, and air.

Importance:

They determine the types of living organisms that can survive in a particular area, as each organism requires specific environmental conditions to grow and survive.

A balanced ecosystem arises from:

The interaction of biotic and abiotic factors together, maintaining the continuity of life within the biosphere.

Example:

Lake ecosystem:

Algae, fish, and bacteria (biotic components) interact with the physical and chemical properties (abiotic components) of lake water in a continuous cycle of matter and energy exchange.



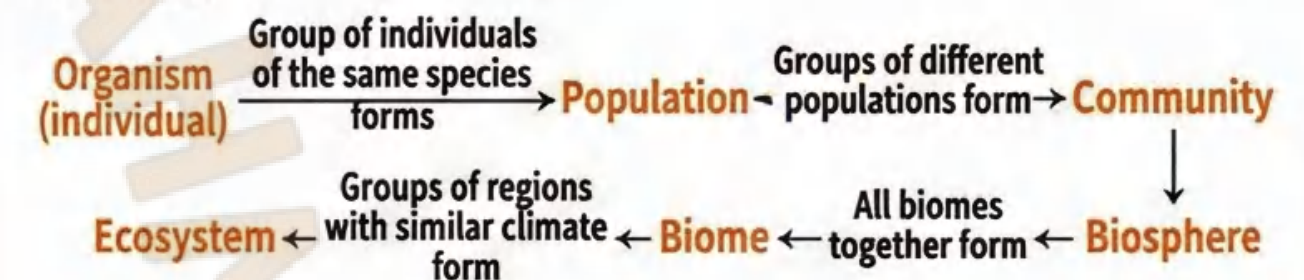
Levels of Organization in the Biosphere

* Living organisms exist within an integrated system; no species can exist in isolation from other living organisms or from the surrounding environment.

* Life on Earth is organized into graduated levels of complexity, starting with the organism (the first and smallest level) and ending with the biosphere (the highest and most comprehensive level), where:

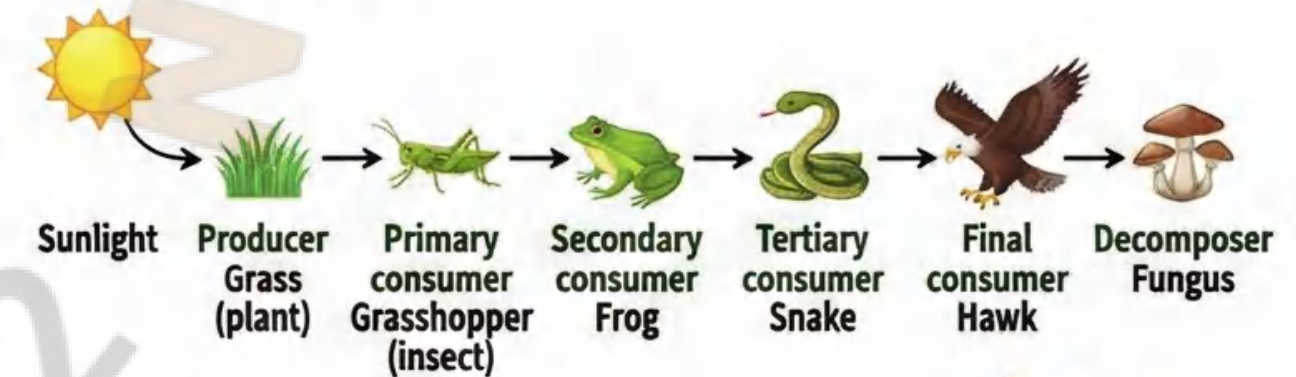
- Each higher level consists of a group of lower levels.
- Complex and reciprocal interactions occur between levels, ensuring the survival of organisms and the balance of ecosystems on Earth.

* The hierarchical levels of organization in the biosphere can be illustrated as follows:



Food Chains and Food Webs

Food chain: A pathway that shows the transfer of energy and nutrients from one organism to another within an ecosystem. Food chains may be terrestrial or aquatic.



Food web: A group of interconnected food chains within a particular ecosystem.

Types of food webs:

1) Simple food webs:

- More dependent on limited food sources, as in desert environments.

2) Complex food webs:

- Consist of multiple interconnected food chains.



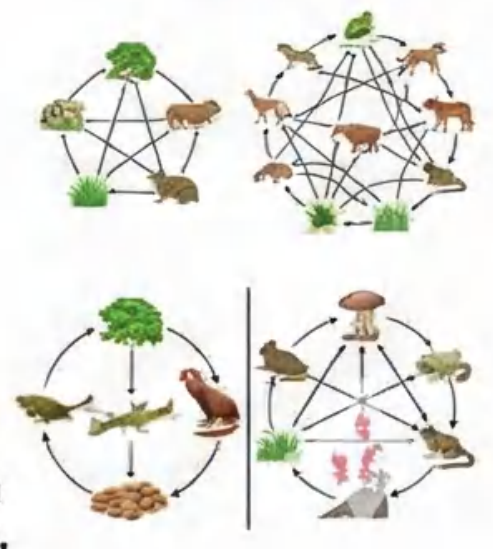
Effect of food chain interconnection within a food web:

1) Positive effect:

- Makes the biological community more resilient to the loss of a single species.

2) Negative effect:

- May have widespread negative effects, such as removal of plant cover or water pollution.



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